I CLAIM:

1. A rotary tool for drilling into a soil formation from its surface, controllably injecting water and binder at known depths below the surface of said formation, and mixing said soil, water and binder to form an in-situ piling, said tool comprising:

a rotary shaft having a central axis of rotation adapted to be driven bi-directionally around said axis, and bi-directionally along said axis;

a vane on and extending radially from said shaft to be rotated around and moved axially by said shaft, said vane being so disposed and arranged as to move through the formation along a helical path to drill into said formation, to stir the material of the formation, and ultimately to mix the material of the formation with water and binder;

a water injector and a binder injector carried by said tool, each injector having a respective axis of emission of water or of binder, said axes of emission being directed away from said tool into said formation at a respective location along said central axis;

said injectors being so disposed and arranged relative to one another that the material of their emissions will during a limited number of revolutions of said shaft, encounter one another, then to be mixed as a pre-determined ratio of water and of binder, said water including water emitted from the water

injector and water which may have already been present at that location.

2. A rotary tool according to claim 1 in which said injectors are set in said shaft with their axes of emission substantially normal to said central axis, and located along said central axis such that the emission of one of them will, within a limited number or rotations of the shaft encounter and mix with the other in a temporally suitable time related to the curing of the binder and drainage of the water.

3. A rotary tool according to claim 2 in which said injectors are disposed about 180 degrees apart as viewed in lateral section.

4. A rotary tool according to claim 1 in which the said water injector and binder injector are provided as a pair, their axes of emission intersecting adjacent to said shaft under in-situ pressure whereby to produce a mixture of water and of binder with a velocity having a radial component of motion.

5. A rotary tool according to claim 1 in which said binder injector is surrounded by a plurality of water injectors, the axes of emission of said water injectors intersecting the axis of

emission of the binder injector

6. A rotary tool according to claim 1 in which said injectors are set in said vane at a radial distance from said shaft.

7. A rotary tool according to claim 6 in which the said water injector and binder injector are provided as a pair, their axes of emission intersecting adjacent to said shaft under in-situ pressure whereby to produce a mixture of water and of binder with a velocity having a radial component.

8. A rotary tool according to claim 2 in which a pair of said water injectors and at least one of said binder injectors are set in said shaft, with said binder injector located axially between said water injectors.

9. A rotary tool according to claim 2 in which a pair of said binder injectors and at least one of said water injectors are set in said shaft, with said water injectors located axially between said binder injectors.

10. In combination:

a rotary tool according to claim 1; and

a control valve respective to each of said injectors, whereby the rate of supply of water and of binder can independently be regulated by said control valve to provide binder at a rate desired at a respective depth and water at a rate desired which with existing water already in the formation at that depth, will constitute at least sufficient water for stoichiometric reaction of the binder.

11. A combination according to claim 10 in which a program controls said control valves to establish the rates of supply of the binder and the water.

12. A combination according to claim 11 in which said rates are related to already known water conditions and binder requirements at respective depths below said surface.

13. A combination according to claim 11 in which said rates are related to water conditions sensed at depths below said surface.

14. A combination according to claim 10 in which said injectors are set in said shaft with their axes of emission substantially normal to said central axis, and located along said central axis such that the emission of one of them will, within a

limited number or rotations of the rotary tool encounter and mix with the other in a temporally suitable time related to the curing of the binder and drainage of the water.

15. A combination according to claim 10 in which the said water injector and binder injector are provided as a pair, their axes of emission intersecting adjacent to said shaft under in-situ pressure whereby to produce a mixture of water and of binder with a velocity having a radial component of motion.

16. A combination according to claim 10 in which said binder injector is surrounded by a plurality of water injectors, the axes of emission of said water injectors intersecting the axis of emission of the binder injector.

17. A combination according to claim 10 in which said injectors are set in said vane at a radial distance from said shaft.

18. A combination according to claim 10 in which a pair of said binder injectors and at least one of said water injectors are set in said shaft, with said water injectors located axially between said binder injectors.

19. Apparatus according to claim 1 in which a baffle is fixed to each said vane to confine emissions from said injectors to the region encountered by said vanes.

20. The method of forming an in-situ piling in a soil formation with binder and sufficient water to produce a stoichiometrically correct mixture, comprising:

with a rotary tool, drilling into said formation, said tool having a rotary shaft that has a central axis of rotation and a vane for drilling into and mixing the soil, rotated around and moved axially by said shaft, said vane being so disposed and arranged as to move through the formation along a helical path to drill into said formation, to stir the material of the formation, and ultimately to mix the material of the formation with water and binder;

a water injector and a binder injector carried by said tool;

driving said tool axially into and out of said formation while rotating it;

at some times during axial movement of said tool, discharging water or binder from a respective injector into said soil formation along a respective axis of emission of water or of binder, said axes of emission being directed away from said tool into said formation at a respective location along said central

axis, so that the material of their emissions will during a limited number of revolutions of said shaft encounter one another, there to be mixed as a pre-determined ratio of water and of binder, said water including water emitted from the water injector and water which may have already been present at that depth.

21. The method of claim 20 in which injection of binder is made during passage of said tool into said soil formation.

22. The method of claim 20 in which injection of binder is made during passage of said tool out of said soil formation.

23. The method of claim 20 in which injection of water is made during passage of said tool into said soil formation.

24. The method of claim 20 in which injection of water is made during passage of said tool out of said soil formation.

25. The method of claim 20 in which the emissions of said injectors intersect adjacent to said shaft.

26. The method of claim 20 in which the emission of one of said injectors is encountered in said soil formation in a

temporally suitable time related to the curing of the binder and drainage of the water.

27. The method of claim 20 in which the emission of water id determined by a program responsive to data from a representative core.

28. The method of claim 20 in which the emission of water is determined by a program responsive to data relating to water content already in the soil derived from a sensor on said tool disposed at an axial location below the place of injection of said binder.

29. The method of claim 20 in which the pressure of the stream of water and of the binder in the tool is above the ambient pressure which exists in the formation.